

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY


(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 17 FEB 2006

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Applicant's or agent's file reference URC050BWO		<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. PCT/EP2004/009936		International filing date (day/month/year) 07.09.2004	Priority date (day/month/year) 05.11.2003	
International Patent Classification (IPC) or national classification and IPC B01D53/56, B01D53/86, B01D53/94, C01C1/02				
Applicant UREA CASALE S.A. et al.				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 2 sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand  06.05.2005		Date of completion of this report  16.02.2006		
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer  Eijkenboom, A  Telephone No. +49 89 2399-8616		



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2004/009936

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

1-8 as originally filed

**Claims, Numbers**

1-7 received on 08.09.2005 with letter of 05.09.2005

**Drawings, Sheets**

1/1 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☒ the claims, Nos. 8
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2004/009936

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	1-7
Inventive step (IS)	Yes: Claims	
	No: Claims	1-7
Industrial applicability (IA)	Yes: Claims	1-7
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Ad Section V:**

1. In relation to the discussion of the prior art documents, reference is made to the passages cited in the International Search Report.

US-B1-6 361 754 B1 (D1) discloses a method for the removal of NO<sub>x</sub> from combustion flue gas with NH<sub>3</sub> generated by hydrolysis of urea and intermediate accumulation of NH<sub>3</sub> in surge vessel (14) before use.

Original claim 1 was amended by including the features of original claim 2, thus specifying that the pressure at which the ammonia is accumulated is between the pressure at which the hydrolysis takes place and the pressure at which it is introduced into the flue gas.

However, this amendment fails to render amended claim 1 novel over the disclosure in D1 since the person skilled in the art understands that the pressure in the surge vessel, because of the ordinary pressure losses in line (12), heater (13) and subsequent piping, also lies below the pressure at which the hydrolysis reaction takes place. Since D1 further indicates (column, 20- that the ammonia is fed via line (26) and valve (20) to a simple low-pressure nozzle (28), the pressure at which the ammonia is introduced into the flue gas appears to be below the pressure in the surge vessel for the same reasons.

Contrary to the opinion of the applicant, D1 also includes (column 5, lines 53-column 6, line 4) the pressure regulation between the hydrolysis, surge vessel and nozzles by means of pump (16), pressure gauge (P), valve (20) and controller (18). In addition, it is a matter of course to the skilled person that the function of the surge vessel (24) in D1 is to dampen upstream and downstream pressure fluctuations. Finally, as in the current application, D1 also seeks to provide close controlled reagent dosing to better track spikes in NO<sub>x</sub> level (column 6, lines 12-26; lines 41-58).

As a corollary of the above, the subject-matter of claim 1 is not considered new in the sense of Article 33(2) PCT.

2. US-A-6 093 380 (D2) refers to the removal of NO<sub>x</sub> of combustion flue gas with NH<sub>3</sub> generated by urea hydrolysis whereby the lean urea solution from the hydrolyser is recycled to the dissolver and heat-exchanged against the rich solution from the dissolver to the hydrolyser.
3. In accordance with the last paragraph of the description, the gaseous ammonia could be accumulated at a pressure lower than the hydrolysis pressure by virtue of a pressure reducing valve placed between the hydrolyser and the accumulator in order to be independent from upstream and downstream pressure fluctuations.

However, in the light of the disclosure in D1 and D2, it is considered to lie within the scope of the skilled person to include a pressure reducing valve after the hydrolysis in the method of D1 if the circumstances make this desirable, as is, for example, shown in figure 2 of D2. In this embodiment control valves (112) and (158) as well as ejector (160) cause such a pressure reduction (column 9, lines 49-58).

Hence, if the subject-matter of claim 1 would be rendered novel over D1 by including a pressure reducing valve between the hydrolyser and the accumulator, an objection for lack of inventive step (Art.33(3) PCT) would remain.

4. Dependent claims 2-7 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).

**Ad Section VIII:**

1. The term "damp" in the description and claims seems to be a mistranslation, whereby the term "removal" appears more appropriate.
2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D2 is not mentioned in the description, nor are these documents identified therein.
3. The subject-matter of dependent claim 4 lacks clarity (Art.6 PCT) in that it merely

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

PCT/EP2004/009936

relates to a result to be achieved.

- 9 -

## CLAIMS

1. Method for the damp of the nitrogen oxides contained in combustion flue gas through treatment with gaseous ammonia, in which said gaseous ammonia is generated in situ  
5 by hydrolysis reaction of an aqueous urea solution (L4) and the ammonia generated by said hydrolysis is accumulated in gas state, under pressure, in an accumulator (A5), characterized in that the pressure at which said gaseous ammonia is accumulated is between the pressure at which  
10 said hydrolysis reaction takes place and the pressure at which it is introduced into the combustion flue gas.
2. Method for the damp of the nitrogen oxides contained in combustion flue gas according to claim 1, characterized in that said aqueous urea solution (L3) is preheated in a  
15 heat exchanger (A3) through heat exchange with a hot aqueous hydrolysis solution (L6) generated in said hydrolysis reaction, and in that said aqueous hydrolysis solution, following said heat exchange, is overcooled and then used as recycling solution (R).
- 20 3. Method for the damp of the nitrogen oxides contained in combustion flue gas according to claim 2, characterized in that said recycling solution (R) is fed to a mixer (A1) for the formation, together with a concentrated aqueous urea solution (L1) and/or solid urea, of said aqueous urea  
25 solution (L4).
4. Method for the damp of nitrogen oxides according to claim 1, characterized in that at least 99.8% of said urea in aqueous solution is hydrolyzed under pressure generating gaseous ammonia.

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5. Method for the damp of nitrogen oxides according to claim 1, characterized in that the aqueous urea solution subjected to said hydrolysis reaction has a urea content of between 10% and 70% by weight.
- 5 6. Method for the damp of nitrogen oxides according to claim 1, characterized in that the temperature at which said hydrolysis reaction takes place is between 100°C and 240°C.
- 10 7. Method for the damp of nitrogen oxides according to claim 1, characterized in that the pressure at which said hydrolysis reaction takes place is between 500 kPa and 3000 kPa.

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